Froebel Trust Podcast

Transcript : Episode 20

January 2026

00:00:00 - 00:00:55
Colin Kelly
Hello, this is Episode 20 of the Froebel Trust podcast. I'm Colin Kelly, and this time we're talking maths. Alongside language, being able to work with numbers and problem solving is an essential life skill. But how can a Froebelian approach to education help with this? And how can it help educators themselves who might lack confidence in their own mathematical abilities? Parents know how important it is to read to young children, but what's the maths equivalent? We'll explore the importance of learning in 3D in a two-dimensional world, and we'll look at the role of woodwork as a method of introducing mathematical approaches.

00:00:56 - 00:01:20
Colin Kelly
Well, as ever, I'm joined by a wonderful panel of guests for this discussion. Michael Friedman is a historian of mathematics, currently a research associate at Bonn University Germany. He's particularly interested in Froebelian activities and playful objects and how they transmit mathematical knowledge. Jane Whinnett is a Froebel Trust traveling tutor and a familiar voice to regular listeners of this podcast.

00:01:21 - 00:01:38
Colin Kelly
And Pete Moorhouse is another familiar voice and a Froebel Trust traveling tutor. He's an early year's creative consultant and researcher and has written several books, including 'Learning Through Woodwork' published by Routledge. Pete is going to share his perspective on the role woodwork can play in maths education.

00:01:39 - 00:01:54
Colin Kelly
You can find out more about all my guests in the podcast description, but let's start with Jane. Why is maths important for education, particularly a Froebelian approach to maths, and is it different with babies, toddlers, and older children?

00:01:55 - 00:02:05
Jane Whinnett
Well, I think maths is everywhere. Maths is kind of everything and from the moment we're born, we're actually beginning to think mathematically.

00:02:06 - 00:02:30
Jane Whinnett
So, I think we probably aren't aware of all the uses that we put mathematics to. And a lot of it is embedded in our experience and I think that is probably where Froebel's coming from, or some of his ideas are coming from. Where you've got those embedded mathematical ideas in practical real-life experiences and particularly nature for Froebel.

00:02:31 - 00:03:13
Jane Whinnett
I know that people get very frightened when you talk about maths and almost get brain freeze. You know, the first thing most people will say is, 'I was no good at maths.' And I think it's something that we really need to counter in our culture to say, that actually, we're using maths all the time in our everyday lives. Every time, you redecorate your house, you're using maths, you're trying to work out whether, a new kitchen unit's going to fit in the kitchen, you need maths. Every time you sort of tap along to a piece of music, that rhythm and beat is mathematical. We buy clothes, we look at sizes. It's part of our everyday experience.

00:03:14 - 00:03:43
Colin Kelly
It's funny, isn't it? Like you're saying, people get scared about maths in, there's almost sometimes an acceptance that, oh well. I'm just not good at maths. Whereas if somebody was to say that about language, we would say, 'alright, well you need to go and fix that.' And we would look at where am I as a baby with language? Where am I as a toddler with language? Are you suggesting that maybe we should put that same emphasis on maths at these different stages?

00:03:44 - 00:04:12
Jane Whinnett
I think it's about children's holistic development and maths has to be part of it. It's about understanding the world around you. And part of that is understanding and communicating through language, but it's also about, maths. And I think we see that at different stages in babies, development, thinking about, those very Froebelian early ideas of same and difference. And that you talked about the law of contrasts or the law of opposition.

00:04:13 - 00:04:56
Jane Whinnett
And I think that's the kind of experience that babies need rather than having flat screen experiences, having real experiences of real objects, to handle, to be able to put in your mouth, to smell, all those sensory things that, babies need for their development to develop their thinking. And not in isolation, they need those experiences along in a relationship with someone else, their family, their primary carers, their brothers and sisters being part of the world. And then I think there becomes a consciousness in the adult of, oh, right, okay, so you're starting to think mathematically. So, a baby might start indicating they want more.

00:04:57 - 00:05:13
Jane Whinnett

Well, that's immediately a mathematical thing of, you've got some, but actually you want to add to it. So, I think it's looking for those little opportunities that parents and educators can pick up on right from very young children.

00:05:14 - 00:05:26
Colin Kelly
Thank you, Jane and Michael, what does developing mathematical knowledge, understanding, and skills actually mean in Froebelian terms?

00:05:27 - 00:05:48
Michael Friedman
Well, that's an excellent question. First of all, I have to support Jane in what she said. I think our conception of mathematics is very much, literally traumatised by some sort of an idea of mathematics, which is just solving equations or having to do with, derivatives, for example. A concept that is stuck, but no one knows what it is.

00:05:49 - 00:06:13
Michael Friedman
And obviously this is not what Froebel had in mind when he came to teach children and babies, et cetera, how to learn mathematics. So, for him, first of all, and I think this is essential to underline here, the way one approaches mathematics for him in the historical context is first of all, with very concrete objects.

00:06:14 - 00:06:34
Michael Friedman
That is geometrical objects. You begin with a sphere and then you move on to a cylinder, a cube, a partitioned cube, and then you move on to, let's call it more complex activities. Now already with these geometrical forms, you already have, some sort of an access or approach to both geometrical forms and to arithmetical operations.

00:06:35 - 00:06:56
Michael Friedman
That is, you have the concept of what it is to divide a cube into two, into four, into eight. That is, you already have the concept of a fraction without someone from above telling you, okay, this is the concept of a fraction. Because the child doesn't need it to be honest.

00:06:57 - 00:07:05
Colin Kelly
Yeah. Thanks Michael. Well, now I'd like to explore why the Froebelian approach is important for teaching young children maths.

00:07:06 - 00:07:14
Colin Kelly
What does it add and how does it differ maybe from other approaches? Jane, would you like to maybe start us off on that?

00:07:15 - 00:07:41

Jane Whinnett
Well, I think, it's very practical and hands-on and using blocks particularly, and we're thinking about younger children probably before they start school, initially, and really thinking about how do we see though that kind of block play today. Most settings would not have Froebel's original gifts, but they might have wooden blocks.

00:07:42 - 00:08:09
Jane Whinnett
And I think we can see a lot of the same kinds of relationships in those wooden blocks if you have a complete set that you see in Frobel's gifts. So, I think it's that thing of concretely seeing when you're building, 'oh, here's a gap. I need another block that is the same size.' So, you're not necessarily aware of a numerical value of that block, but you can see that it's missing.

00:08:10 - 00:09:05
Jane Whinnett
So, you concretely understand that there's part of that equation of equivalence missing, and you have to find it to make your model. So, I think, that's quite an interesting thing, finding equivalence. I think there's also something about, building in three dimensions. I think we go very quickly, a lot of approaches go very quickly to two dimensions and also very quickly to representation through notation. So, writing numbers and things, which actually you need a lot of experience before you start getting to the point where you need to make that kind of notation. I feel, I think that sometimes we start that too early before children really understand what the numbers mean and how they relate to the quantities or whatever in the real, in the real world.

00:09:06 - 00:09:21
Colin Kelly
Yeah. And the Froebelian approach is using objects, real objects, shapes; whereas maybe other settings that, that don't go the Froebelian way, they are, they're writing things down and, and it's, I guess that's more abstract?

00:09:22 - 00:09:59
Jane Whinnett
Yeah, I think that is, to a certain extent, true, but we have to recognise that it's not just Froebelian settings that use, shapes. Obviously, Montessori settings would use, shapes, but probably in a very different way. I would say that they're used much more didactically rather than they're sort of self-correcting, There's one way to do things with a lot of the equipment, whereas I would see a Froebelian approach being more creative, but I also have to say, it goes beyond blocks and gifts and occupations because it's about children's real experience, in the world.

00:10:00 - 00:10:26
Jane Whinnett
So, things like baking and woodwork all have mathematical experiences within them, embedded in them. It's not about isolating one particular part that would be Froebelian. I think it's about that holistic experience of bringing that all together. And there's also that

really important thing that Froebel talked about, being able to represent your inner ideas in an outer form.

00:10:27 - 00:10:46
Jane Whinnett
So that can take all sorts of different, ways of doing it. It could come through blocks; it could come through those two-dimensional shapes. It could come through lines through drawing and painting. So, I think we have to think really widely about it. And also, I think that's what makes it accessible for all children.

00:10:47 - 00:11:04
Jane Whinnett
We're living in a very diverse society now, and I think that children's own cultural experiences are really important in their learning to make it relevant for them. And I think a Froebelian approach allows us to do that.

00:11:05 - 00:11:16
Colin Kelly
Well, let's bring in Pete Moorhouse now just to expand on what Michael and Jane have been saying and working with woodwork and how that can be used to sort of unlock mathematics.

00:11:17 - 00:11:26
Colin Kelly
And we know that woodwork is a Froebelian occupation. Pete could you just maybe tell us a little bit about how you think maths and woodwork can be connected?

00:11:27 - 00:12:05
Pete Moorhouse
Yeah, absolutely. Woodwork really incorporates just so many elements of mathematical development, practically all the maths that we need to be covering during the foundation stage can certainly be covered at the woodwork bench, but it's also, around mathematical problem solving. It's about mathematical language. It's really far reaching. Interestingly, the latest research on mathematical development from the Williamson Review just highlights that mathematical development happens most effectively in concrete situations rather than being abstract.

00:12:06 - 00:12:28
Pete Moorhouse
It also highlights that spatial thinking is an absolute foundation for mathematical thinking, making visual representations of size and quantity and so forth. So that's very much enhanced through working with wood, working with the three-dimensional objects. And there's just, there's so many different elements to it.

00:12:29 - 00:12:50
Pete Moorhouse

Actually, I'll just give you an example, around the spatial thinking. A young boy was working on making a train and he was very carefully putting on the wheels, but just the, the way that he was spacing them out so regularly, just a wonderful way to enhance that sort of like spatial thinking.

00:12:51 - 00:13:08
Pete Moorhouse
Again, another two children were making a ladder and the way they were equally spacing out the rungs of the ladder. So, it happens in so many different situations, particularly obviously when you're matching the shape of one piece of wood to be able to join it neatly to another piece is very apparent.

00:13:09 - 00:13:31
Pete Moorhouse
But when we think about mathematical development, with woodwork number really springs out. There's so much opportunity for thinking about numeracy and quantity. In terms of counting, children will be sabotaging, making visual assessments of quantity. They'll be also doing basic touching and counting, whether it's the number of screws or the number of wings that they've added onto their model.

00:13:32 - 00:14:11
Pete Moorhouse
There'll be basic addition and subtracting. It might be working out how many wheels to add to each carriage of the train that they're making. So, a lot of elements around mathematical thinking. It's interesting, when you think about it, when you're sawing a piece of wood in half, we're making, we're dividing essentially when we're joining bits together, we're making a whole. A young child who's actually making a table has cut that length into four quarters. So, a really, beautiful sort of introduction to mathematical thinking and problem solving really, and fractions and division, absolutely through woodwork.

00:14:12 - 00:14:25
Colin Kelly
Do you think it's important, Pete, then, if a child is doing these things, I guess one key tenet of education is that if you learn and develop something in one area, that you then are able to apply it in another.

00:14:26 - 00:14:40
Colin Kelly
So, when people are making these patterns or dividing one into two, or having four wheels with a regular space between them, is it important that these connections are pointed out to them, or do you just let them absorb it somehow?

00:14:41 - 00:14:45
Pete Moorhouse
There’s certainly a role in us reflecting back learning to children.

00:14:46 - 00:15:33

Pete Moorhouse
When we reflect on learning it embeds it in a very powerful way. That's where it comes into the sensitivity of the adult, of knowing when to interact, when to hold back. What we're always trying to do when children are engaged with a variety of different materials is to really retain that engagement and that flow. So sometimes it can enhance it when we interact and reflect. Other times it can be disruptive. So, it is not something that we do, constant feedback on terms of that. But at times, absolutely, it's a wonderful opportunity to be introducing mathematical vocabulary, to have them reflect back the quantity that they've used, talking about that positional language that they've used within their models.

00:15:34 - 00:15:57
Pete Moorhouse
So, there's so many opportunities for really embedding those mathematical concepts. And again, the research… we know that between 90-95% of all neural connections are made by a time a child's aged five. This is the time to be creating a foundation from which children can build their future mathematical developments.

00:15:58 - 00:16:08
Pete Moorhouse
So, making these new neural pathways and highways, these foundation elements, of mathematical thinking is really important.

00:16:09 - 00:16:18
Colin Kelly
Yeah. Well, it certainly is important, but I guess one of the challenges facing the profession that Jane and Michael touched on earlier, is that some of the educators might have had bad experiences themselves.

00:16:19 - 00:16:38
Colin Kelly
Michael even used the word ‘trauma’ around maths, maybe they're carrying that with them. They're bringing it into the setting when they're educating children and maybe there's an unease and a lack of confidence around maths. And Jane, I'm wondering if perhaps the Froebelian approach, maybe might be able to help the educators as well.

00:16:39 - 00:17:02
Jane Whinnett
Yes. I believe that it can, doing those practical activities yourself is a really good way of thinking about, maths, and I think the pamphlets are really good at that kind of help for educators. Reading through those you can see the links with lots of different areas of the curriculum. But you see it in woodwork, I see it in sewing, you see it in cooking.

00:17:03 - 00:17:27
Jane Whinnett
So, I think kinda almost having that mathematical hat on when you're doing activities really helps you to build up your confidence and actually having staff discussions about it too, because everybody's going to be at a different stage in their understanding about,

mathematics. And no matter what group of people you're in, they will all say, oh, I'm no good at math.

00:17:28 - 00:17:43
Jane Whinnett
Don't ask me about math, but, I think, in a group there's kind of solidarity and you can develop your confidence within that. And also, we have to look out to experts and to people who've got lots of experience in the field, I think.

00:17:44 - 00:17:58
Colin Kelly
Yeah. Thanks Jane. Now those pamphlets that Jane mentioned, there are a number of Froebel Trust pamphlets that link quite nicely with what we're talking about in this episode, and they'll support you if you're trying to apply a Froebelian approach to mathematics in your setting.

00:17:59 - 00:18:23
Colin Kelly
You can download all of these pamphlets for free from the Froebel Trust website and you'll find a direct link to them in the podcast description. Or you can visit the podcast page at froebel.org.uk. Well let's go back to Pete now. I know that woodwork is a real area of interest for you. Do you think that woodwork can be used to support educators to develop mathematical thinking?

00:18:24 - 00:18:52
Pete Moorhouse
I mean, unfortunately, a lot of teaching around maths in the past has been very didactic. You're either getting it right, or you're getting it wrong. So, we can have that sense of failure. So, I think that really emphasises again the importance of really imbuing children with a joy and a love of mathematical thinking, of making these visual, assessments, of quantity.

00:18:53 - 00:19:16
Pete Moorhouse
Talking about numbers, doing basic mathematical calculations, giving them that confidence and that love of mathematics. There's a certain beauty to mathematics, which Froebel was only too aware of. A lot of the mathematical shapes that he introduced to children were very much based from forms seen in nature.

00:19:17 - 00:19:35
Pete Moorhouse
Looking at the geometries within flowers and petals and snowflakes and, it's so abundant in the natural world. So, I think, children tune into those natural patterns and sequences that they observe in various contexts, in particular when they're working with woodwork.

00:19:36 - 00:19:59
Pete Moorhouse

And I guess also in terms of woodwork, there's lots of opportunities to weave in other areas of mathematical developments. Thinking about time. Thinking about wood itself, looking at the tree rings, the years that it is, thinking how long it takes trees to grow. There's a lot of thinking about seasons, so there's lots of ways of thinking about time.

00:20:00 - 00:21:05
Pete Moorhouse
Also, in terms of the chronology of the making process as well. Reflecting back, how long did it take to make that model? And then we've got all of the really rich thinking about measurements and pattern and shapes and position. It's incredible how rich it is. That the mathematical development, recognising two dimensional shapes, three dimensional shapes, all of that, the language that goes with that: flat, straight slope, angles, et cetera, and all the opportunities for matching and sorting, comparison, speculation and so forth. So, I think, it just encompasses so many different elements. But I think for me, where it gets particularly interesting is when children really start to apply their mathematical thinking skills. So, here, they're analysing what's gone wrong, they've got a problem, so that's a critical thinking skill and that analysing problem, then having to generate other creative ways of how they can solve this problem.

00:21:06 - 00:21:24
Pete Moorhouse
And I think that's just, yeah, really exciting. I mean, there was a boy who made a little table, for example, and his table was wobbling, so we were wondering, I was saying, ‘well, I wonder why it's wobbling’. And he looked at it for quite some time and suddenly came to that realisation that each of the legs were slightly different lengths, which was why it was wobbling.

00:21:25 - 00:22:00
Pete Moorhouse
And then a few weeks later, he wanted to make a bigger table, but this time he was determined all his legs were going to be the same length. And he couldn't read numbers, but he, he used a little unit length to get all each of the legs exactly the same length. So that application of mathematical thinking. There was another child, another wonderful example actually. And when we introduced quite a lot of mathematical equipment to young children in the woodwork area. rulers, tape measures, spirit levels, set squares, and people are often a little bit surprised that we're introducing set squares to three or four year olds.

00:22:01 - 00:22:17
Pete Moorhouse
But my feeling is, if they can get their head around the word Tyrannosaurus Rex and the fact that these animals lived 50 million years ago, we're just talking about a corner, it's not a farfetched concept. And they love, once it's been demonstrated, they love using it for marking the wood off, ready for sawing.

00:22:18 - 00:22:44
Pete Moorhouse

But then every now and again, something quite special happens. And there was one boy who's making a boat and he'd added a mast to the boat, but then he got over the set square and then held it up to his mast so he could make sure that mast was really standing up straight. So, you can't construct that learning you. It is just, that's what I say about children naturally, problem solving, when we make these sort of like experiences available to them.

00:22:45 - 00:22:56
Colin Kelly
Thank you for that, Pete, and some wonderful examples in that answer. I can certainly relate to the child you mentioned with the wobbly table and I'm not sure if we would've figured that out quite as soon as he did.

00:22:57 - 00:23:14
Colin Kelly
Michael, if I could bring you in here. We hear a lot about Froebel and the emphasis on materials, and I know that you've done a lot of work on Froebel's crystallography. Can you tell us about that and how it links to maths with young children and the use of materials?

00:23:15 - 00:23:23
Michael Friedman
Froebel was a trained crystallographer, which means he had access to all of the three-dimensional models of crystals that were available in this time.

00:23:24 - 00:23:44
Michael Friedman
And by this a lot of three-dimensional wooden models of various, three-dimensional objects like the cube, the truncated cube, et cetera, and all the other three-dimensional bodies one can imagine. And he actually took this idea of modelling and transferred to the activities that, were given to the children.

00:23:45 - 00:24:08
Michael Friedman
And this is actually the start of all the playful activities. We're talking about the beginning of the 19th century where crystallography was not, let's call it a consolidated science, but there were various approaches. One of them was the approach that was later, developed into what we know as atoms.

00:24:09 - 00:24:37
Michael Friedman
That is, well, all materials are composed of atoms, and all crystals are composed of, basic building blocks, which are modelled by these models that gave to the children. And the other trend is what is called a dynamic approach to matter, which is related to what Jane, actually mentioned, this law of the sphere, of these oppositions, which attract and repulse, which is also something that Froebel integrated into his own pedagogy.

00:24:38 - 00:24:59
Michael Friedman

But respect to mathematics, the beginning is with very one may even say simple material activities that eventually transmit one may say unconsciously mathematical concepts. And this is extremely important. You don't begin with definition of what is a number because who cares.

00:25:00 - 00:25:10
Colin Kelly
Michael, you mentioned crystallography, and I'm wondering, just to make sure we've all got this same sort of basic understanding, can you just explain what crystallography is?

00:25:11 - 00:25:31
Michael Friedman
Crystals are…we see them every day. Salt is a crystal for example, now there were two basic approaches to crystals. One was the, let's call it the atomic approach, which was actually supporting the idea that crystals are actually composed of basic units, today called molecules or atoms.

00:25:32 - 00:26:27
Michael Friedman
And these basic units have a very constant structure. You have a crystal. Then this crystal is being composed of, for example, hundreds of mini cubes. This was exactly the view of the beginning of the 19th century. This is on the one hand. On the other hand, there was another view, which, was much more supported or advocated by Froebel and his colleagues in Germany, that nature is something that emerges from, let's call it two powers, attraction and repulsion and all of nature, no matter what, is always a result of the interaction of these two powers. And in crystals these two, these various powers have their own very special structure, and hence, we get these crystals.

00:26:28 - 00:27:21
Michael Friedman
Now this is, as you can already note, a very, let's call it philosophically loaded approach. And it is no wonder because it was very much interlaced with philosophical views regarding the world. Now Froebel in a sense, took these two approaches, integrated both of them into its pedagogy. On the one hand, the models that he later integrated into his gifts and occupations, which were models of crystals of the basic units of crystals. Hence, he was just taking the basic objects of the first, let's call it an atomistic approach. However, his entire pedagogy, that mathematics is a manifestation of the universal law that covers nature, is very much taken from this, romantic, idealistic approach to crystals.

00:27:22 - 00:27:26
Michael Friedman
So, this is, in a nutshell, what was crystallography.

00:27:27 - 00:27:42
Colin Kelly

Yeah. And I guess a very basic explanation is crystallography is the study of crystals. But that takes Frobel to start looking at structure. And he starts looking at the laws of nature, which I know is something he keeps coming back to again and again.

00:27:43 - 00:28:08
Colin Kelly
And he gives children gifts or blocks or shapes thinking that if he just lets them play with these that they will somehow, they've got this kind of innate sense and connection to the laws of nature and that they will take themselves to maths, which is fascinating and really builds on some of the themes that we've discussed in other episodes in this podcast.

00:28:09 - 00:28:37
Colin Kelly
We also see Froebel yet again challenging convention and taking two philosophies, and rather than embracing one as wholly correct and dismissing the other, you said that he takes a bit from each of them and sort of makes his own out of his own philosophy but grounded in these universal laws of nature. Pete, I wondered if you could maybe tell us a little bit more about this and the difference between this approach rooted in crystallography and some of the other approaches.

00:28:38 - 00:28:58
Pete Moorhouse
Well, absolutely. Frobel was clearly, a visionary pioneer of education and right from the beginning he really, those two key concepts that he passionately believed that children learn most effectively through play. And he also really believed in really rich hands-on experiential learning.

00:28:59 - 00:29:16
Pete Moorhouse
And I think that is the secret of it is not having, a, a specific mathematical provocation table, which you see in a lot of nurseries where, a whole bunch of little plastic teddy bears that they use for counting or something. And this is just going to be a counting exercise.

00:29:17 - 00:29:36
Pete Moorhouse
Froebel very much believed in having a much more integrated approach to learning. So, learning holistically through interactions with materials. Whether it's through block play, whether it's through working with clay, whether it's working with woodwork, and all of these media, are completely holistic.

00:29:37 - 00:29:54
Pete Moorhouse
Children will be, developing their physical development. the fine motor skills, the hand-eye coordination, their language and communication, scientific thinking, looking at cause and effect, creativity, that symbolic representations that so often occurs, but also mathematical development.

00:29:55 - 00:30:22
Pete Moorhouse
This is happening in a such a natural sense just through play, exploration, encountering problems, how we resolve those. And it's proven to be incredibly effective. I think when children are bringing that sense of autonomy and intrinsic motivation to their learning, when they're in the very centre, making their own choices, their own decisions, that's when rich learning occurs.

00:30:23 - 00:30:41
Colin Kelly
Yeah. Thank you, Pete. Michael, maybe we could bring you back in here. I know there's some people listen to this podcast, some educators who are dealing with very young children, maybe under twos, maybe even babies. How do you think Frobel would've introduced those very young children to mathematical concepts?

00:30:42 - 00:31:06
Michael Friedman
Well, first of all, I think the first stages would be really to introduce them to the most basic geometrical objects. And then let them, as Jane said, experience with them. Obviously, we have to separate here two levels. One of them is what the children are doing at this stage, which is obviously at the age of two, you cannot expect now from any child to understand what is a fraction.

00:31:07 - 00:31:37
Michael Friedman
One eighth for example. However, there is obviously there are activities of assembling and de-assembling a cube into eight smaller cubes which obviously does transmit the idea of what is a fraction. And this is done also with other activities as the children grow up. With folding for example, you can fold a square piece of paper along the diagonal, then fold it again, and then you have the idea of what is a half.

00:31:38 - 00:31:46
Colin Kelly
And Pete, is there anything that modern day educators can be doing to introduce this approach to maths, to very young children in babies? And what do you think that would look like?

00:31:47 - 00:32:01
Pete Moorhouse
One of the richest resources for the younger children and for all ages is block play. Just because of the mathematical relationships contained within the blocks are so rich.

00:32:02 - 00:32:31
Pete Moorhouse
But I do think that block play is quite extraordinary. I mean, just recently I was observing a girl in the morning. She was making a little dolls house out of the blocks. And then she decided she wanted to make aa staircase. And she spent about 45 minutes making this

staircase. And it was extraordinary 'cause it was really even in terms of the steps, but the challenge was creating the structure underneath to fill the spaces.

00:32:32 - 00:33:20
Pete Moorhouse
So, it was all around working out the measurement, the special sort of dynamics to be able to do this. And in the process, her staircase collapsed several times, but she was so determined. But it was just amazing to see that quantity of mathematical thinking involved in that. And I think, with blocks especially, you've got measurements, you've got the space, you've got the size, the length, the mass, all of the properties, the balance, the weight, the fractions that are inherent within block play, the different shapes, the forms, the angles, all of the different types of symmetries that children often create within their block play, whether it's radial symmetries, mirror symmetries, fourfold, symmetry and so forth.

00:33:21 - 00:33:32
Pete Moorhouse
So, it's so incredible, I think in terms of just making those building blocks literally for a mathematical foundation is incredibly rich.

00:33:33 - 00:33:48
Colin Kelly
Yeah, absolutely. Thanks Pete. Well Michael, back to you. How do you think Frobel would've approached some of the issues we were talking about a little earlier? We were speaking about educators' lack of confidence in their own abilities in maths.

00:33:49 - 00:34:06
Michael Friedman
It's clear that he doesn't aim now, to instruct the teachers to use specifically concepts that should be taught to the children. That is, we're not dealing here with anything that is something that might be called, the axiomatic method.

00:34:07 - 00:34:21
Michael Friedman
That you begin with basic concepts. You say these are the operations, these are the basic relations, move forward. Because this is obviously the method that is used in today's schools, which is a catastrophe to be honest.

00:34:22 - 00:34:36
Colin Kelly
Wow. So, for example, the way I learned the times table, which is basically memorising it, going through all the lines again and again and again, and I know the times table inside out. Correct me if I'm wrong, you're saying Frobel wouldn't teach it like that.

00:34:37 - 00:35:13
Michael Friedman
He wouldn't teach it like that in the sense that it wouldn't begin with it. Obviously, we all have to multiply at some point in our life or to add. This is true, but this should not come at

first place. And exactly like Jane said, today's transition to symbols and to start writing down everything, but not understanding before that sort, the reality around us is not only three dimensional, but is already mathematically embedded, is not something that Froebel would've agreed, let's call it like that.

00:35:14 - 00:35:20
Colin Kelly
You used the phrase. You said as a catastrophe, so why, why do you think it's a catastrophe?

00:35:21 - 00:35:35
Michael Friedman
Well, this is my own personal opinion, because everything is being two-dimensional, two dimensionalised. You can see it in today's society that, everyone, well, at least my nieces and nephews are glued to their screens really physically glued.

00:35:36 - 00:36:00
Michael Friedman
There is nothing three dimensional and I think Froebel's intuition and it, it was very right. It was to begin with the three-dimensional world with cylinders and spheres and cubes, and then move on, let's call it two lower dimensions to the two-dimensional world and one dimensional, and then move again to, let's call higher dimensions.

00:36:01 - 00:36:25
Michael Friedman
And you can see it perfectly well in how he introduces his own activities, his gifts and occupations. But you do not move directly to symbolisation, either by numbers or by equations in later age, or immediately start drawing. That is you, you do begin with something physical because obviously we are three dimensional beings.

00:36:26 - 00:36:34
Colin Kelly
Yeah. And Pete, you've been listening there. Do you agree that focusing on 2D in education is, as Michael put it, catastrophic? What's your view on that?

00:36:35 - 00:36:54
Pete Moorhouse
Yeah, well it is interesting. We live in a three-dimensional world, don't we? Sadly, at the moment, I think it's even becoming more problematic in the fact that, we've got this new generation of children moving through our schools who have essentially learn to swipe before they can walk.

00:36:55 - 00:37:13
Pete Moorhouse
So they are, absolutely immersed in a two-dimensional world. So I think, having really rich three-dimensional experiences, working with our hands and mind together as we interact with materials is incredibly important for cognitive development. And I think sometimes it's a bit of a myth.

00:37:14 - 00:37:31
Pete Moorhouse
Because sometimes we talk about, working with our hands as being a manual activity, but actually, we can't operate our hands without using our brain. So it's actually, it's a very cognitive way of working. So, yeah, I couldn't agree with, with, with him more.

00:37:32 - 00:37:37
Colin Kelly
I guess one of the things is that there's so much pressure of time these days.

00:37:38 - 00:38:00
Colin Kelly
You're talking here about children having an experience and there are some parents, I suppose, maybe, who are more outcome driven. They just want their children to learn. They just want their children to know this stuff. And I've had parents saying things like, oh, well they, they learn fractions from Minecraft, in some of these screen-based technologies.

00:38:01 - 00:38:16
Colin Kelly
Do we need to learn maths the same way that we used to? And I get what you're saying, it's building up this wonderful experience. It's developing my brain. But when there's so many other pressures of time, what would you say to people who say, well, look, you can learn maths off an app.

00:38:17 - 00:39:00
Pete Moorhouse
It's interesting. I think for me, it always comes down to, what actually are the skills that empower us to become really rich, lifelong learners. And that isn't, learning facts and figures at an early stage. It's about developing those core attitudes to learning those habits, so I'm talking persistence, perseverance, resilience, bouncing back when things go wrong, the flexible thinking, adapting, changing course, risk taking, being driven by their own curiosity, these dispositions, which actually we need to be really building.

00:39:01 - 00:39:09
Pete Moorhouse
And that happens through absolutely through play, exploration and children directing, their learning.

00:39:10 - 00:39:25
Colin Kelly
And Jane, do you have anything to add to that? It's sounding like if you stay in the real world a bit longer, it's maybe giving children more time to make sense of maths and perhaps avoid some of that trauma of feeling that ‘I'm not good at maths.’

00:39:26 - 00:39:44
Jane Whinnett

Yeah, and I think that link to nature is very important because, you only need to go a walk at certain times of the year and you can see, spheres in nature, a dandelion clock where all the all the little heads are all as far apart from each other as possible.

00:39:45 - 00:40:06
Jane Whinnett
Because it gives them the best chance to seed somewhere else when the wind blows. And if you cut across stems in nature, you discover that stems are all different, shapes inside. So actually, you can find cylinder, stems. And I have to thank my fellow tutor, Kate Razell for this information.

00:40:07 - 00:41:24
Jane Whinnett
Because I hadn't noticed this myself, that there are some plants that have got triangular stems and so when you cut them across you get sort of triangular prisms and there are all sorts of different shapes. So, I can imagine that Froebel knew this from his interest in nature, and I think it links to that interest in Crystallography too, because there's that kind of, the idea about forces in it too, isn't it? The idea of a bubble or a dandelion head with the forces, the opposing forces act in there and it changes what happens. I'd quite like to go back to what you said about the folding, Michael, because I was thinking about when we used to have napkins in nursery, that were cloth napkins and, every day the children, got them in a ring and the ring had the number, a number on so they would get the correct napkin. But they would take them out and use them. And then at the end of lunch they would fold them up and put them back in the ring. And the educator who sat with them used to encourage them to fold in different ways. So, folding it in half different ways, so you can do corner to corner or edge to edge, and then, from that you can create other shapes.

00:41:25 - 00:41:53
Jane Whinnett
So it was a very sort of routine, kind of practical thing that happened on a daily basis. And children got to know the names of the shapes. They got quite imaginative about how they might, try and roll it up and get the cylinder ring back onto it. It is a very practical way I think, of exploring, that kind of folding and in some ways easier than paper. I suppose it's less rigid.

00:41:54 - 00:42:17
Colin Kelly
Yeah, it's fascinating listening to you all, and I'm reflecting a bit on my own upbringing. I didn't have a Froebelian education, Jane, but I absolutely remember being with friends of mine, if there were napkins, you know, people playing and trying to fold them up in different ways and get them into the rings and that natural curiosity and creativity that you're talking about.

00:42:18 - 00:42:41
Colin Kelly
And Pete, you spoke earlier about resilience, and my dad was always very good at woodwork and joinery and I really wasn't, I'm still dreadful at it. I grew up thinking, if I

would work alongside my dad and try and help him with something, I grew up thinking that he just had some sort of natural knack for woodwork and joinery that I didn't have.

00:42:42 - 00:43:19
Colin Kelly
And then as I got older, if he was around, in my house helping me with a job and I would look closely, I would realise that actually, he was continually making mistakes. Things were going wrong all the time, but he just had this attitude, which was, where I would, at the first hint of trouble I'd throw my hands up and walk away and give up. But he has this attitude of, well, I'm going to persevere. I know, I'll figure it out. I'll make this fit, or I'll make it not wobble. We'll get there. And I guess you can apply that resilience and that perseverance to all sorts of areas of life.

00:43:20 - 00:43:38
Pete Moorhouse
No, absolutely. For me, that's one of the most special things about woodwork and particularly with your, well, with anybody really. It is an incredibly problematic material to work with. Nothing is entirely straightforward. For young children, how am I best gonna join this bit to this?

00:43:39 - 00:43:59
Pete Moorhouse
How can I change the shape of this to make it how it needs to be? Which of all these weird offcuts is best going to express what I need it to do? So, they're constantly using those critical thinking skills, that creative thinking skills and these are key lifelong learning skills, and they absolutely transfer from one area of learning.

00:44:00 - 00:44:07
Pete Moorhouse
They can apply them in mathematical situations, in scientific situations, and yeah. In any number of different ways.

00:44:08 - 00:44:25
Colin Kelly
Yeah, this all sounds great, but I'm just thinking of some of our listeners and the challenges that educators face. And I know a big one right now is cost. Jane a material like paper for folding you mentioned is relatively low cost, and, and readily available.

00:44:26 - 00:44:47
Colin Kelly
And I know there's lots of recycled paper options as well. But Pete, when it comes to something like wood, I talk to any joiner, try and get any work done around your home, and you'll hear all about the cost of wood. It's really at a premium, isn't it? And I'd hate for educators to dismiss what we are saying because they think they can't afford it.

00:44:48 - 00:44:53
Colin Kelly

So I'm wondering, Pete, if you've got any advice on getting round that issue of cost when it comes to woodwork?

00:44:54 - 00:45:08
Pete Moorhouse
Yeah, I can't deny that there is a certain cost associated with embedding woodwork and quite a bit of effort in terms of establishing your woodwork area and getting all the most ergonomic recommended tools.

00:45:09 - 00:45:29
Pete Moorhouse
But I think, once you start to see the results and the impact on children's learning and development and self-esteem and confidence, it absolutely pays back that investment. Initially with the youngest children, we do start with a soft material. Just to really ensure that initial experience is really positive.

00:45:30 - 00:45:46
Pete Moorhouse
We don't want to put children off by trying to hammer a big nail into a block of wood. They're just going to find that frustrating and they're going to make a decision. 'I don't like woodwork', so we have a very clear progression. But very quickly they can be moving on just to using recycled off cuts.

00:45:47 - 00:45:57
Pete Moorhouse
So, we find we get lots of donations from parents and local builders and carpenters. So, once you've got over that initial start, the costs are really quite manageable.

00:45:58 - 00:46:11
Colin Kelly
And Jane, what about time? Do educators really have time to wait for me to get there, or do you think that some of them are feeling a pressure to rush things through a little bit? And if so, how can the Froebelian approach help overcome that?

00:46:12 - 00:46:33
Jane Whinnett
I think you're right. I think there is a pressure, and a lot of people feel quite pressured by their country's curriculum sometimes, depending on how that is set up and what the expectations are for attainment really. However, what I would say is actually if you tick a box and that child is nowhere near that thing, you've actually got an empty box.

00:46:34 - 00:47:20
Jane Whinnett
And not only have you got an empty box, you've got a child that's not understanding now and probably will not understand in the future because there are certain aspects of mathematics that are linear. And I think if you don't understand those fundamental basics, you've got nothing to build on. So actually, by rushing through we're depriving children of

the experiences they actually need for the future. And I was really interested, Michael, to read in one of your articles about paper folding and how that experience is used sometimes in very mathematical situations to solve problems that are way beyond any maths that I ever did.

00:47:21 - 00:47:38
Jane Whinnett
But that's a theoretical maths. I think, but without those experiences in early childhood, would that person be able to get to that stage where they've been able to think of the fold as a completely different way of understanding things.

00:47:39 - 00:47:52
Colin Kelly
Michael, one thing I remember from my own education, and it was always the thing you feared was whatever age you were at, a teacher saying, 'Colin is falling behind in maths.'

00:47:53 - 00:48:04
Colin Kelly
And I'm guessing from what you're both saying in the Froebelian approach, that wouldn't have happened, you wouldn't have been able to fall behind because it would've been more directed at my pace anyway.

00:48:05 - 00:48:36
Michael Friedman
Yeah, very much agreed. That's obviously this is not a Froebelian approach, obviously not in the kindergarten. There isn't some scale along which one is measured and what is your progress, but obviously it is important that children will at least get acquainted with the various call it practices, objects that embed mathematical principles, even if they're not, being introduced to the concept or they are introduced, but they don't understand.

00:48:37 - 00:49:06
Michael Friedman
It's obviously not the point here. In general, I think you're very much right that there are, once mathematics becomes more and more sophisticated, then there are other approaches to mathematics which do stay on this level of embodied knowledge that is using material practices but it's clear that these people, had they not had any idea about material practices.

00:49:07 - 00:49:32
Michael Friedman
And it doesn't matter if they were taught in Froebelian kindergartens or not, they would not have reached these solutions. So, it's clear that Froebel had in this sense, a very good intuition while it's actually needed in order that children will understand mathematics and it's not about solving equations. That is, it's even preposterous to think like that.

00:49:33 - 00:49:38
Colin Kelly

Yeah. Well, I'm with you. I'm with you a hundred percent, Michael. Jane, I can see you want to come in here as well.

00:49:39 - 00:50:04
Jane Whinnett
I just wanted to talk a bit about pattern and thinking about important patterns in mathematics and, having those experiences of creating pattern with for example, the two-dimensional little tiles and thinking about that sort of computational thinking that's actually going to take you eventually onto coding and, you know, for computing.

00:50:05 - 00:50:16
Jane Whinnett
So, I think, without those concrete experiences of creating those kinds of patterns and working those through, how are you going to get to that language at the end?

00:50:17 - 00:50:36
Colin Kelly
Yeah. And Jane, you know, as a parent myself, it feels like you're forever being told about the benefits of reading to children and singing to them and telling them stories. And I wonder is there a way that those songs and poems and reading, can that be used to help get maths across?

00:50:37 - 00:51:19
Jane Whinnett
Yes, and I think Froebel used that as well. If you look at some of his, mother songs, you can see there, that emphasis on, when you get to the stage of isolating the fingers, he names them and then begins to use them to count. And I think, finger play is still very much part of our, tradition in early learning and childcare settings now. So yes, he wrote that mother songs book, family songs to support families to develop their holistic education of their children. So, it was through music and movement and relationships with family members.

00:51:20 - 00:51:41
Jane Whinnett
And as I say, there were all these individual songs that helped with that kind of counting. And then the illustrations, there's one in particular that has a lot of groups of five things. So, there are five, family members in the picture there are five deer, there are five ducks.

00:51:42 - 00:52:04
Jane Whinnett
And it's a bit like the counting books that you get now when you sit with a child, and you can point and count at the different objects. I think also there are some rhymes further on in the book about money and going to the, to the market and particularly at Christmas time and, you know, being able to buy things.

00:52:05 - 00:52:31
Jane Whinnett

And also, one about the value of money and, how the children have gone to this workshop to buy a target for shooting arrows at. And it's to cost, three pence and they're saying it's too expensive. And the man who's making it says, oh, it costs one for the board. 'Cause you need a strong board, one for the cross of the sticks to put on the board.

00:52:32 - 00:52:52
Jane Whinnett
And the other one is for labour. And it's important to value the labour of the person who has made that. And I thought, do you know, that's a very interesting and modern interpretation as well, you know, of valuing what people have done. And that runs through all of the mother songs, that valuing of people in the community.

00:52:53 - 00:53:12
Jane Whinnett
There's possibly not so much the shape aspects or the geometric aspects in the mother songs. Well, and actually of course, the mother songs were developed for almost children before they were going to kindergarten or just going into kindergarten. So perhaps that was the way into the gifts and occupation.

00:53:13 - 00:53:17
Colin Kelly
And its repetition and pattern and participation, isn't it? Doing things absolutely in the real world.

00:53:18 - 00:53:32
Jane Whinnett
Yeah. And that opportunity to count, you know, music helps you in that rhythm. That's really important. You know, being able to recite numbers forwards and backwards is a skill that you need.

00:53:33 - 00:53:54
Jane Whinnett
Being able to count on one count back, one songs often do that and I think having those, you know, those fingers that you to physically represent is also a stage in that progression from manipulating and having real objects to getting towards representing in notation. So, yeah.

00:53:55 - 00:53:57
Colin Kelly
And Pete, is there anything you'd like to add to that?

00:53:58 - 00:54:27
Pete Moorhouse
Unfortunately there's been so much wrong with the way maths has been taught, in schools previously. It is a very didactic, it's two plus two, is four. It's not, well, let's have a think, what are the different ways that we can make four, we can do any number of different ways, having those, having a much more creative approach where children are more

cognitively engaged, really getting to grips and understanding their concepts that are involved.

00:54:28 - 00:54:46
Pete Moorhouse
But also with maths, it is one of those areas in terms of, moving further up the school where you do need a logical progression of thought. And if children haven't, mastered one phase, your next phase gets even more difficult and suddenly you feel like you are failing.

00:54:47 - 00:55:09
Colin Kelly
A lot of parents and educators and carers, their worst fear is that the child falls behind in maths. And if we look at what Jane Whinnett and Michael Friedman said earlier in the podcast, they talked about taking a mindful approach to maths. So, I'm wondering how can we slow things down so that children are able to take that mindful approach to maths?

00:55:10 - 00:55:40
Pete Moorhouse
Having a slow pedagogical approach to everything that we're doing is really important. There is such a demand on time. Increasingly both, within school and within the home, making time to reflect on work, making time to have these conversations, getting involved ourselves as educators in the process, with those open-ended questions, opening up conversations with sustained shared thinking skills.

00:55:41 - 00:56:00
Pete Moorhouse
So, we are bringing it in. But as you mentioned, all children are developing a different rate at different stages. So rather than assuming that all children are gonna be at the same stage of in development, we need to slow down and tune into that individual child. Where are they with their mathematical development?

00:56:01 - 00:56:11
Pete Moorhouse
Where are they with their language development? Where are they with their physical development? It's about, being bespoke and supporting each individual child in that unique way really.

00:56:12 - 00:56:31
Colin Kelly
And what advice would you give to someone, Pete, if they've thought it through, they've got a suitable space. They've maybe had some wood donated from a local supplier, and they're thinking, right, starting next week, let's bring the wood in. Let's bring maths to life a little bit. Where would you suggest they start?

00:56:32 - 00:56:46
Pete Moorhouse

Well, in terms of ensuring maths is incorporated, I'd always recommend, having a bunch of mathematical tools easily accessible to the woodwork area.

00:56:47 - 00:57:05
Pete Moorhouse
So, I would have rulers, I would have tape measures. I wouldn't use those large metal retractable ones. They're quite hazardous. The dress makers ones, the ones with the cotton. They're still retractable, but they have a fabric, having spirit levels.

00:57:06 - 00:57:24
Pete Moorhouse
And I think once you've got some of this mathematical equipment, children are really intrigued and use it. It's amazing how often they'll bring out the measure to see how their models are getting bigger. I think for us it's just like highlighting. A child might be hammering on a row of buttons onto a piece of wood.

00:57:25 - 00:57:39
Pete Moorhouse
Sometimes they'll be playing. In the same process. they might put in the first button with one nail, the second button with two nails, the third button with three nails, the fourth button with four nails, and then actually go back down the other way and then go back to 3, 2, 1.

00:57:40 - 00:57:53
Pete Moorhouse
So, they're naturally made a sequence just by being playful and seeing that they can do this. So, then it's about reflecting it back, what you've observed, helping them notice what's just occurred really.

00:57:54 - 00:58:03
Colin Kelly
Yeah, and it's, it's amazing, isn't it? We always see, when Frobel was developing his ideas all these many years ago, just how applicable it all is today.

00:58:04 - 00:58:46
Pete Moorhouse
Yeah. I just think it's mind blowing when you stop to think about it that there was Froebel back in, the early 18 hundreds, we're going back in time. Electricity hadn't been invented. It's going way back. And for him to have really tuned in and observed children's development so closely and then bring in his knowledge through botany, maths, his work working as a crystallographer, all weaving together to see how he could really enhance their work with three dimensional forms through the occupations, and, incredibly progression from the solid to the surface, to the line, to the point and then back again.

00:58:47 - 00:59:03
Pete Moorhouse

And I think one of the lovely things is that finally, when you get back to the solid with woodwork, children can even saw up little blocks and create their own blocks. Taking them back to a lovely symmetry, starting back where it all started with those initial blocks in there. Yeah, gift number three.

00:59:04 - 00:59:20
Colin Kelly
Jane, if there's somebody listening to this, maybe an educator, and they feel a lack of confidence around their own approach to maths, and they maybe feel the setting isn't quite getting it right and they're interested in exploring the Froebelian approach to maths, what would be a good way for them to start?

00:59:21 - 00:59:46
Jane Whinnett
I think a good way is to actually try out things for yourself and discover things for yourself, but you need someone who knows a bit more than you, alongside you as well. And finding colleagues that can help you with that is really important. Doing reading, keeping abreast with new publications that come out, particularly those that are focused on young children.

00:59:47 - 01:00:14
Jane Whinnett
And using your Froebelian lens to think, okay, is this something that I think is appropriate for young children or is there something that I think is better? So come on a Froebel course. Our different elements, really support, some of that mathematical thinking, particularly probably element two about gifts and occupations. As I say, do it for yourself and try to think, mathematically when you're actually doing it.

01:00:15 - 01:00:26
Colin Kelly
Now we've been speaking about gifts and occupations. Michael, you spoke about folding. We've covered woodwork and block play. Would you say that weaving is something that can help develop mathematical knowledge too?

01:00:27 - 01:01:00
Michael Friedman
Jane was mentioning patterns and Froebel also developed another activity which was for older children called plating or weaving, which dealt with, it's called weaving patterns. This activity, which obviously demanded much more control of your body, of your hands. How you played and weaved strips of paper, into one another was already transmitting more abstract mathematical ideas.

01:01:01 - 01:01:24
Michael Friedman
So, it wasn't just counting, it was already pattern recognition and recognising forms that would emerge from this plating activity. And in this sense, it was, I think for Froebel one of the later gifts or occupations because it demanded from the children more and they had to be, quasi adults, or at least older.

01:01:25 - 01:01:51
Michael Friedman
But again, it followed the main concepts of his pedagogy, which was not to introduce concepts at the beginning and then say, okay, what happens if we weave the even and uneven strips of paper, but rather let the children experiment and see what kind of, what other concepts would emerge from this activity.

01:01:52 - 01:02:04
Michael Friedman
But again, it wasn't about first conceptual thinking. Then have them plate whatever they would do correctly or not, but rather when experimenting with patterns.

01:02:05 - 01:02:29
Jane Whinnett
Yeah. Yeah. And I think that nowadays we probably do that more with actual physical weaving. And a lot of nurseries have started to weave and the language of it going, in and out and, forward or backwards and it's a bit like odd even, isn't it, that, that pattern in numbers. Odd. Odd and even.

01:02:30 - 01:02:44
Colin Kelly
It’s interesting what you're saying about that, about these patterns, there's often a comfort that comes with that. There's a comfort, there's a peace sometimes. And reflecting on my own children, you could see that that was making sense to them.

01:02:45 - 01:02:52
Colin Kelly
And it's almost like the antidote to that trauma that we talked about. So it's quite interesting that actually in some way, maths can bring peace.

01:02:53 - 01:03:02
Jane Whinnett
Yes. And also, it's quite a mindful or slow, pedagogical approach. You can't go fast doing it, you've got to, it's, yeah, it’s slow.

01:03:03 - 01:03:25
Colin Kelly
It's slow. That magic word again. And that's Jane Whinnett drawing this Episode 20 of the Froebel Trust Podcast to a close. Thanks to Jane, Pete Moorhouse and Michael Friedman for being such fascinating and generous guests. You can find out more about each of them and their work in the notes in the podcast description, there's also links to further resources, including all those Froebel trust pamphlets that were mentioned.

01:03:26 - 01:03:35
Colin Kelly

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